ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
AIR PERMITS PROGRAM

TECHNICAL ANALYSIS REPORT

For Air Quality Control Construction Permit No. 079CP02
Project X-238

Alyeska Pipeline Service Company
Pump Station 9

STRATEGIC RECONFIGURATION

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Proposed: December 29, 2004

Table of Contents

Abbreviations/Acronyms

AAC .....Alaska Administrative Code
ADEC.....Alaska Department of Environmental Conservation
APSC.....Alyeska Pipeline Service Company
AS .....Alaska Statutes
ASTM.....American Society of Testing and Materials
CEMS .....Continuous Emission Monitoring System
C.F.R. .....Code of Federal Regulations
COMS.....Continuous Opacity Monitoring System
DLE .....Dry Low Emissions
eghp .....exhaust gas horsepower
EPA .....Environmental Protection Agency
HHV .....Higher heating value
MACT .....Maximum Achievable Control Technology
mr&r .....monitoring, recordkeeping, and reporting
NAICS .....North American Industry Classification System
NESHAPS .....National Emission Standards for Hazardous Air Pollutants
NSPS .....New Source Performance Standards
PS 9 .....Pump Station 9
PSD.....Prevention of Significant Deterioration
SIC .....Standard Industrial Classification
SN .....Serial Number
TBD.....To Be Determined

Units and Measures

bhp .....brake horsepower or boiler horsepower [1]
gr./dscf.....grains per dry standard cubic feet (1 pound = 7,000 grains)
dscf .....dry standard cubic foot
gph .....gallons per hour
kW .....kiloWatts
kW-e.....kiloWatts electric[2]
mmBtu.....million British Thermal Units
ppm.....parts per million
ppmv.....parts per million by volume
tph .....tons per hour
tpy .....tons per year
wt%.....weight percent

Pollutants

CO .....Carbon Monoxide
HAPS.....Hazardous Air Pollutants
H_2S .....Hydrogen Sulfide
NO_X .....Oxides of Nitrogen
NO_2.....Nitrogen Dioxide
NO .....Nitric Oxide
PM-10.....Particulate Matter with an aerodynamic diameter less than 10 microns
SO_2 .....Sulfur Dioxide
VOC .....Volatile Organic Compound

[1] For boilers: One boiler horsepower = 33,472 Btu-fuel per horsepower-hour divided by the boiler's efficiency. For engines: approximately 7,000 Btu-fuel per brake horsepower-hour is required for an average diesel internal combustion engine.
[2] kW-e refers to rated generator electrical output rather than engine output

1.0 Introduction

Alyeska Pipeline Service Company (APSC) submitted a construction permit application dated September 9, 2004 to the Alaska Department of Environmental Conservation (the department), for the strategic reconfiguration project at Pump Station 9 (PS 9). APSC submitted revisions to the modeling analysis on the application on November 3, 2004.

APSC requested concurrent processing of the construction permit application and revised operating permit as allowed under 18 AAC 50.310(b). The department intends to incorporate the terms and condition of this construction permit into the operating permit as an administrative revision after EPA's 45 day review period.

1.1 Stationary Source Description

PS 9 is an existing pump station located 105 miles south of Fairbanks Alaska. PS 9 functions to transport crude oil from the North Slope of Alaska to the Valdez Marine Terminal of the Trans Alaska Pipeline. The area surrounding PS 9 is classified as attainment or unclassifiable for all pollutants.

1.2 Project Description

The proposed project is part of a strategic reconfiguration initiative to reduce operating and future maintenance costs. APSC plans to replace the existing crude oil pumps with variable speed electric motor driven pumps to reduce operating and maintenance costs. APSC plans to decommission three Rolls Royce Avon combustion turbines each rated at 24,000 exhaust gas horsepower (eghp), one Garrett combustion turbine rated at 510 kiloWatts (kW), one Solar Saturn combustion turbine rated at 800 kW, and two Eclipse therminol heaters each rated at 20.6 million British thermal units per hour (mmBtu/hr). These units are identified as Emission Units 1 through 7 in Table 1 of initial Operating Permit No. 079TVP01. The only existing equipment that will remain is a Cummins N-855F firewater pump and a 350 barrel (bbl) distillate fuel storage tank (Units 8 and 9 in Table 1 of initial Operating Permit No. 079TVP01).

APSC plans to purchase most of the electrical power needed to run the pumps from the Golden Valley Electric Association. For backup power and periodic peak power shaving they plan to install two 2.25 megaWatt (MW) Caterpillar 3516B (Cat 3516B) reciprocating internal combustion engines (RICE) generators. They also plan to install one 65 kW RICE to provide back-up power for a new communications module. Table 1 of Construction Permit No. 079CP02 identifies the new units as Emission Units 10 through 12.

Table 1 shows project emissions as provided in the application and revised by the department. Note that the emission totals listed in the table are **not** the stationary source emissions. "Proposed Potential Emissions" are the emissions from proposed units 10 through 12 and "Past Actual Emissions" are from existing Emission Units 1 through 7 that are to be decommissioned. These emission estimates do not include emissions from other emitting units at PS 9 (Emission Units 8 and 9 – the firewater pump and a storage tank).

Table 1 - Project Emissions Summary with Permit Limits, tpy

Pollutant	Proposed Potential Emissions	Past Actual Emission	Change	PSD Major Modification Threshold	PSD Major Modification?
NO_X	396.9	373.1	+23.8	40	NO
CO	12.5	159.7	-147.2	100	NO
PM-10	3.11	10.3	-7.2	15	NO
VOC	5.41	0.4	+5.0	40	NO
SO_2	29.3	166.5	-137.2	40	NO

To calculate "Past Actual Emissions" from the units that APSC plans to decommission as part of this project, APSC determined the two-year average emissions from 2002 and 2003 calendar years. APSC based actual NO_X and CO emissions for Units 1 through 3 (Rolls Royce Avon turbines) on monthly heat consumption, corrected for ambient temperature and fuel heat content. They estimated sulfur emissions using actual fuel sulfur content. They estimated sulfur emissions using actual fuel sulfur content (0.20 weight percent sulfur). APSC treated these emissions as credits to offset the emissions increase from the proposed units.

The department did not revise any of APSC "Past Actual Emissions" estimates provided in the application.

APSC's "Proposed Potential Emissions" calculations in the application include the following assumptions.

1. Emission Units 10 and 11 (3516B Cats) limited to 11,200 hours per 12 consecutive months.
2. The NO_X emission factor for Units 10 and 11 is 61.6 lb NO_X per hour, based on vendor data at 100 percent load. APSC adjusted the total NO_X emissions from these units upward to account for humidity at PS 9.
3. Emission Unit 12 (65 kW RICE) limited to 300 hours per 12 consecutive months.
4. Diesel fuel limited to 0.24 percent sulfur by weight (wt% S).

The department's comments and revisions of APSC's proposed emissions estimates are as follows:

1. APSC based NO_X and CO emissions for the 65 kW RICE on Tier 1 standards listed in 40 C.F.R. 89.112, Table 1. The department revised the emissions using emission factors from AP-42 Table 3.3-1, because APSC did not provide any supporting vendor or source test data. The resulting emissions changes were negligible.
2. Absent backup documentation, the department was not able to verify whether the humidity correction factor of 0.87 that APSC used in calculating NO_X emissions for Units 10 and 11 (Cat 3516B's) is correct. Given that the resulting emissions increase are well below PSD Major thresholds, and the ambient impacts are well below

ambient standards and increments, the department did not request additional information to support the humidity correction factor.

3. Emissions from Unit 8, the firewater pump, are not included in the "Past Actual Emissions" estimates or in the "Proposed Potential Emissions" shown in Table 1. Potential emissions from this unit will decrease as a result of the hourly limit in this permit, so this is a conservative assumption for the purpose of PSD applicability.

1.3 Relevant Permit History

PS 9 is currently operating under initial Operating Permit No. 079TVP01 issued October 13, 2003.

1.4 Department Findings

1. PS 9 is a crude petroleum pipeline transportation stationary source classified under 18 AAC 50.300(c)(1), as a Prevention of Significant Deterioration- (PSD-) Major source that emits more than 250 tons per year (tpy) in an area designated as attainment or unclassifiable. PS 9 is PSD Major, but the department has not reviewed any project at the stationary source under the state-implementation plan-approved PSD program.

2. The project is classified under 18 AAC 50.300(h)(2) because, as limited in this permit, it could cause an increase in actual emissions beyond current allowable emissions for a pollutant for which an ambient air quality standard has been established in 18 AAC 50.010 (NO_X and VOC).

3. Under 18 AAC 50.310(n)(2), an applicant is required to prepare an ambient air quality assessment for a project classified under 18 AAC 50.300(h)(2). Therefore, APSC was required to submit an NO_2 demonstration. The department requested SO_2 and PM-10 demonstrations under the discretionary provision contained in 18 AAC 50.310(c)(5) since these are typical pollutants of concern. The department did not ask for a CO demonstration. APSC's analysis adequately shows that operating their emission units within the requested constraints will not cause or contribute to a violation of the ambient air quality standards provided in 18 AAC 50.010, or the maximum allowable increases (increments) provided in 18 AAC 50.020.

4. As restricted by permit limits, the net emissions increases due to this project are below the thresholds in 18 AAC 50.300(h)(3), so this project will not trigger PSD review.

5. The projects fuel burning equipment is subject to state Air Quality Control regulations 18 AAC 50.055(a)(1) for visible emissions, 18 AAC 50.055(b)(1) from particulate matter, and 18 AAC 50.055(c) for sulfur compound emissions.

6. PS 9 is not located in a coastal zone district. Therefore, the project does not require a project consistency determination under the Alaska Coastal Management Program.

7. The application satisfies the applicable requirements set out in 18 AAC 50.310 and 18 AAC 315(e). Thus, the department has made a preliminary decision to approve the application and has prepared a proposed permit for public notice.

2.0 Ambient Air Quality Protection Requirements

APSC submitted a modeling analysis with their original application and a revised analysis on November 3, 2004. Appendix A contains the department's review memorandum regarding the modeling analysis. APSC's analysis adequately shows that operating their emission units within the requested constraints will not cause or contribute to a violation of the ambient air quality standards provided in 18 AAC 50.010, or the maximum allowable increases (increments) provided in 18 AAC 50.020.

The department included the provisions listed below in the construction permit to ensure APSC complies with key assumptions of their ambient demonstration.

1. Limit the maximum sulfur content of diesel fuel to 0.24 percent, by weight.

2. Limit the annual operation of the two Caterpillar 3516B RICE units to 11,200 hours, combined.

3. Limit the annual operation 65 kW RICE unit to 300 hours.

4. Limit the operation of the existing firewater pump to no more than ten hours per day. Note that the modeling analysis indicates a limit of 10 hours in any 24 hour period, however a ten hour per day limit is adequate. There is not much added benefit in tracking this on a 24 hour rolling basis.

Table 1 and 2 of the attached modeling review memorandum shows the ambient impacts of this project. As a percentage compared to a standard or increment, the ambient impacts of this project are closest the 24-hour SO_2 increment. The impacts for the 24-hour SO_2 increment are about 70 percent of the increment (64/91 ~ 70 percent).

3.0 Limits to Avoid Classification as a PSD-Major Modification for NO_X

As indicated in Section 2.0, APSC is subject to operational limits for NO_X, SO_2, and PM-10 ambient air quality protection for this project. APSC also requested limits to prevent PSD-Major modification classification under 18 AAC 50.300(h)(3). With no emission or operational limits, the department concluded that this project would be PSD-Major for NO_X.

The operational limits included in the ambient air quality analysis for new units are 11,200 hours per 12 consecutive months for Units 10 and 11, combined; and 300 hours per 12 consecutive

months for Unit 12. Table 2 shows the NO_X emissions from the project, with bold font indicating emissions that are subject to a limit. The table also shows, in parentheses, the emissions that would result if no limits were in place. As shown in the table, the limits are necessary to prevent project classification as PSD-Major for NO_X.

Table 2 – NO_X Project Emissions Summary

Equipment	Emissions in tpy
Two Caterpillar 3516B (Units 10 & 11)	**396.5** (620)
65 kW RICE (Unit 12)	**0.4** (11.8)
Total	**396.9** (632)
Previous Actual Emissions	373.1
Increase	**+23.8** (259)
PSD Threshold	40
PSD Major?	**NO** (YES)

Most of the NO_X emissions for this project are from Units 10 and 11 (the Cat 3516B RICE), with a negligible amount from the 65 kW RICE. APSC estimated NO_X emissions of 396.5 tons per 12 consecutive months from Unit 10 and 11, using the assumptions indicated in Section 1.2 of this TAR.

The NO_X increase from Units 10 through 12 is 23.8 tons per 12 consecutive months. Therefore, APSC is at about 60 percent of the NO_X PSD-Major Threshold (23.8/40 ~ 60 percent). All other pollutants have a lower percent increase, or a decrease in emissions.

The department has included an emission cap in the permit for Unit 10 and 11 of 396.5 tons per 12 months. APSC is required to monitor operating hours and calculate NO_X emissions using the vendor supplied NO_X emission factor of 61.6 lb NO_X per hour. The department did not require a source test to verify the vendor supplied emission factor because:

1. the NO_X emissions cap limits the increase to well below the PSD threshold and the NO_X ambient impacts are well below ambient standards and increments, providing a good compliance margin;
2. the permit requires APSC to use the worst case NO_X emission factor (100 percent load), although they probably won't always operate at 100 percent load); and
3. Units 10 and 11 are backup and limited to 11,200 hour per year.

4.0 Alaska Emission Standards

For each new stationary source or modification subject to construction permitting, the applicant must show that the proposed sources comply with state and federal emission standards. The

department has adopted federal New Source Performance Standards (NSPS) and National Emissions Standards for Hazardous Air Pollutants (NESHAP), by reference in 18 AAC 50.040.

PS 9 does not include any NESHAPs or NSPS affected facilities.

Industrial processes and fuel-burning equipment at PS 9 are subject to specific visible emission, particulate, and sulfur compound emission standards listed in 18 AAC 50.055. The department has included in the permit monitoring, recordkeeping, and reporting (mr&r) requirements for compliance with the standards.

4.1 Visible Emissions

Emission Unit 10 and through 12 (RICEs) are fuel burning equipment and are subject to a 20 percent visible emission standard as listed in 18 AAC 50.055(a)(1).

APSC provided vendor data for Units 10 and 11 (Cat 3516B RICE) indicating that the units will comply with the visible emissions standard, therefore, the department will not require an initial compliance demonstration for these units. APSC did not provide an initial compliance demonstration for Unit 12 (65 kW RICE). The department did not require an initial compliance demonstration because the unit is limited to 300 hours per 12 consecutive months.

4.2 Particulate Matter

Emission Units 10 through 12 are fuel burning equipment subject to the state PM standard of 0.05 grains per dry standard cubic foot of exhaust gas (gr./dscf), in 18 AAC 50.055(b)(1).

APSC's application included a PM compliance demonstration for the turbine while operating on liquid fuel. They estimated that the turbines would have PM emissions of 0.0025 gr/dscf on liquid fuel. The department agrees with APSC's demonstration for the turbine and has not included in initial compliance demonstration requirement in the permit.

APSC submitted a PM compliance demonstration for Units 10 and 11 (Cat 3516B engines) and Unit 12 (65 kW engine) on November 26, 2004. They estimated PM emissions of 0.011 gr/dscf for the Cat 3516B engine, and 0.005 gr/dscf for the 65 kW engine. The department agrees with APSC's demonstration for the both engine types and has not included an initial PM emission compliance demonstration in the permit.

4.3 Sulfur Compound Emissions

Emission Units 10 through 12 are fuel burning equipment subject to the sulfur compound emission standard in 18 AAC 50.055(c). Sulfur compound emissions, expressed as SO_2, may not exceed 500 ppm averaged over a period of three hours. As described in the Statement of Basis for condition 5 of initial Operating Permit No. 079TVP01, this is equivalent to a liquid-fuel sulfur content of 0.75 percent for stoichiometric conditions.

For ambient air quality protection, the fuel sulfur at PS 9 is limited to 0.24 wt% S. The mr& r for sulfur compound emissions is essentially the same as for ambient air quality. The exception

is that APSC is required to calculate sulfur compound emissions if fuel sulfur is greater than 0.75 wt% S and report if sulfur compound emissions exceed 500 ppm.

5.0 Permit Administration

5.1 Permit Terms and Conditions

This permit contains the terms and conditions under which APSC is authorized to implement the strategic reconfiguration of PS 9.

5.2 Standard Conditions

Standard permit conditions listed in 18 AAC 50.346(a) applicable to operating and construction permits, specifically emission fees, air pollution prohibited, excess emission and permit deviation reports are already listed in initial Operating Permit No. 079TVP01. With the exception of emission fee condition, this project does not trigger any changed to these conditions so they are not included in this construction permit except by reference to the operating permit. The assessable emissions for this stationary source will change. The department will include the revised assessable emissions in the operating permit administrative revision.

5.3 Construction Permitting Procedures

The department's Title V Office has oversight for all reports, surveillance, records, and inspections of permitted stationary sources. Therefore, APSC shall submit all plans, reports, except excess emission reports, and notices required under this permit to the Title V Fairbanks office, as provided for in Section 10 of initial Operating Permit No. 079TVP01. The permit requires excess emission and permit deviation reports be submitted as described in condition 46 of initial Operating Permit No. 079TVP01.

Appendix A
Modeling Memorandum

MEMORANDUM

State of Alaska
Department of Environmental Conservation
Division of Air Quality

TO: File
DATE: December 20, 2004

FILE NO.: X238 – Modeling

THRU: Bill Walker
Construction Permits Supervisor
Air Permits Program
PHONE: 465-5100
FAX: 465-5129

FROM: Alan Schuler, P.E.
Environmental Engineer
Air Permits Program
SUBJECT: Review of Alyeska PS9 Ambient Assessment

As required under 18 AAC 50.315(b)(1)(A), this memorandum summarizes the Department's findings regarding the ambient assessment submitted by Alyeska Pipeline Service Company (Alyeska) for the "Strategic Reconfiguration Project" at Pump Station 9 (PS9). Alyeska submitted the assessment on September 10, 2004 in support of their air quality construction permit application.[3] The project is not subject to review under the State's Prevention of Significant Deterioration (PSD) program. As described in this memorandum, Alyeska's analysis adequately shows that operating their emission units within the requested constraints will not cause or contribute to a violation of the Alaska Ambient Air Quality Standards (AAAQS) provided in 18 AAC 50.010, or the maximum allowable increases (increments) listed in 18 AAC 50.020.

BACKGROUND

PS9 is an existing stationary source located 10 kilometers (km) south of Delta Junction. The area is unclassified in regards to compliance with the ambient air quality standards. For purposes of increment compliance, PS9 is located within a Class II area of the Northern Alaska Intrastate Air Quality Control Region. PS9 is currently classified as a PSD major stationary source under 18 AAC 50.300(c)(1) and is operating under Air Quality Control Operating Permit 079TVP01.

Alyeska plans to replace the existing crude oil pumps with variable speed electric motor driven pumps. They plan to purchase most of the electrical power needed to run the pumps from Golden Valley Electric Association (GVEA). However, they are also planning to install two 2.25 megawatt (MW) Caterpillar 3516B (Cat 3516) reciprocating internal combustion engine (RICE) generators to provide peak shaving power as well as emergency back-up power should there be a loss in utility power. Alyeska also plans to install a single 65 kilowatt (kW) RICE to provide backup power to a new communication module. The new emission units will replace the following existing units, which will be decommissioned as part of this project: three 24,000 horse-power (hp) Rolls Royce Avon combustion turbines, one 510 kW Garrett combustion turbine, one 800 kW Solar Saturn combustion turbine, and two 20.6 million Btu per hour (MMBtu/hr) Eclipse Therminol heaters. The existing Cummins N-855F firewater pump will remain.

Alyeska requested operational restrictions under 18 AAC 50.305(a)(4) to avoid classifying this project as a PSD major-modification under 18 AAC 50.300(h)(3). The modification will nevertheless increase the annual oxides of nitrogen (NOx) and volatile organic compound (VOC) emissions and is therefore, classified under 18 AAC 50.300(h)(2) for these pollutants. The project will decrease the annual carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter (PM-10) emissions.

[3] Alaska's air quality permit program and associated regulations underwent a major revision that became effective October 1, 2004. Applicants who submitted a complete permit application prior to this date have the option of having their applications processed under either the "new" or "old" program. Per Alyeska's request, the Department is processing the PS 9 application and modeling analysis under the old program/regulations.

According to 18 AAC 50.310(n)(2), modifications classified under 18 AAC 50.300(h)(2) must have an ambient nitrogen dioxide (NO_2), SO_2, and PM-10 demonstration if there is an increase in allowable emissions for those pollutants. Therefore, Alyeska was required to submit a NO_2 demonstration. The Department requested a SO_2 and PM-10 demonstration under the discretionary provision contained in 18 AAC 50.310(c)(5) since these are typical pollutants of concern. The Department did not ask for a CO demonstration.

Alyeska did not submit a formal modeling protocol for this project. However, Alyeska's consultant, RETEC Group, Inc. (RETEC), did contact me on several occasions regarding the modeling analysis. The project file contains copies of several electronic mail (e-mail) messages from this pre-application period.

The Department provided comments regarding the modeling analysis on October 27, 2004.[4] Alyeska addressed the comments and provided a revised modeling analysis in early November 2004.[5]

APPROACH

Alyeska used computer analysis (modeling) to predict the ambient NO_2, SO_2, and PM-10 air quality impacts. RETEC conducted the modeling analysis on behalf of Alyeska.

Alyeska first modeled the PS9 emission units (proposed plus existing firewater pump) using an extensive receptor grid. Alyeska then culled those receptors where the PS9 impacts are insignificant for all pollutants and averaging periods. They then conducted a full impact assessment using the remaining receptors. Alyeska's use of only their significant impact receptors is acceptable.

Model Selection

Alyeska used the U.S. Environmental Protection Agency's (EPA) *Industrial Source Complex Short-Term 3* (ISCST3) model for the ambient analysis. ISCST3 is an appropriate model for this analysis. Alyeska used the current version of ISCT3 (version 02035).

RETEC made minor code changes to ISCST3 to turn off stack tip downwash for capped and horizontal stacks.[6] This change is acceptable and consistent with EPA guidance regarding the modeling of horizontal stacks and vertical stacks with rain caps (see discussion under the "Horizontal/Capped Stacks" section of this memorandum). The Department previously accepted this code change in the ambient analysis that RETEC conducted in support of the Pump Station 5 and the Pump Station 3 strategic reconfiguration projects.[7, 8] RETEC's code change is applicable and appropriate for the PS9 project as well.

ISCST3 will not calculate impacts within the "cavity" downwash region. It instead provides a listing of the unit-receptor combinations for which no calculations are made. There are no cavity-zone receptors in the PS9 assessment. Therefore, Alyeska did not need to use special techniques to address cavity-zone impacts.

Meteorological Data

ISCST3 requires hourly meteorological data to estimate plume dispersion. According to EPA's Guideline on Air Quality Models, five years of adequately representative data should be used (when available) to account for year-to-year variation.

[4] Electronic mail (e-mail) message from Alan Schuler (ADEC) to Pete Miller (Retec), October 27, 2004.
[5] Alyeska replied to the Departments comments in a November 3, 2004 e-mail (with attached letter) from Pete Miller (Retec) to Alan Schuler (ADEC). The Department received the revised modeling files, via FedEx, on November 9, 2004.
[6] RETEC considers the ISCST3 modification as proprietary information. RETEC asked the Department to not release their source code or executable code to third parties without their prior written consent.
[7] Memorandum from Alan Schuler to File, *Review of Alyeska PS5 Ambient Assessment*, June 24, 2004.
[8] Memorandum from William Ashton and Alan Schuler to File, *Review of Alyeska PS3 Ambient Assessment*, October 21, 2004.

Alyeska used the same five years (1991-1995) of meteorological data as recently used by the Ground-based Midcourse Defense (GMD) Joint Program Office (JPO) for the Capability Enhancement/Initial Defensive Operation (CE/IDO) project at Fort Greely.[9] Alyeska obtained the meteorological data from the Department.

GMD-JPO used wind and temperature data collected by the U.S. Army at Allen Airfield (Fort Greely). They augmented the surface observations with concurrent cloud-cover and upper air data from the nearest available source, the National Weather Service (NWS) station in Fairbanks.
PS9 is located approximately 7 km south of the Allen Airfield meteorological data and 170 km south of Fairbanks. The elevation at PS9 is approximately 200-feet higher than the airfield, and there are some terrain features to the southwest of PS9. However, the meteorological conditions at Allen Airfield are adequately representative of the meteorological conditions at PS9. The Fairbanks cloud cover and upper air data are also adequately representative for purposes of modeling with ISCST3.[10]

EPA allows applicants to compare the high second-high (h2h) modeled concentration to the short-term air quality standards and increments if at least one year of temporally representative site-specific, or five years of representative off-site data, are used. When these criteria are not met, then applicants must use the high first-high (h1h) concentration. In all cases, applicants must compare the h1h modeled concentration to the SILs, and annual average standards and increments.

Alyeska could have used the h2h modeled concentration for comparing to the short-term standards and increments since they modeled with five years of data. However, they instead took the conservative approach of using the h1h modeled concentration.

Emission Unit Inventory

Alyeska included the proposed units (the two CAT 3516B units and the 65kW RICE unit) in the AAAQS and increment demonstrations, along with the existing firewater pump.[11] The locations of the modeled PS9 emission units are shown in Figure 4-3 of the permit application.

Alyeska could have excluded the firewater pump from the NO_2 increment analysis since it was constructed prior to the 1988 baseline date. However, their approach is conservative and acceptable. Alyeska theoretically also could have taken credit for the removed units since they contributed to the baseline concentrations. However, Alyeska does not have actual emissions data from the baseline dates for these units.[12] Therefore, Alyeska did not include increment credits in the assessments. This approach provides conservative results and avoids the need to incorporate EPA's policy regarding the modeling of increment credits in complex terrain.

Emission Rates and Stack Parameters

The assumed emission rates and stack parameters have significant roles in an ambient demonstration. Alyeska listed the modeled emission rates and stack parameters in Tables 4-1 through 4-4 of the application. They assumed the following annual operational limits:

- Cat 3516B – 11,200 hours (combined for both units)
- 65 kW RICE unit – 300 hours
- firewater pump – 500 hours[13]

[9] Memorandum from Alan Schuler to File, *Review of GMD-JPO Fort Greely Ambient Assessment,* April 30, 2004.

[10] The Department noted in an April 11, 2003 e-mail, *PS-9 Met Data,* from Alan Schuler (ADEC) to Don Mark Anthony (Alyeska) that the use of Fairbanks cloud cover data is adequate for this application, but *may not* be in future assessments using AERMOD (the upcoming replacement for ISCST3). Therefore, Alyeska *may* need to collect PSD-quality site-specific data for future assessments.

[11] Operating permit 079TVP01states the firewater pump is rated at 400 kilowatts. Alyeska stated in their November submittal that the correct rating is 215 hp. Alyeska used the 215 hp rating in the ambient demonstration.

[12] Alyeska commenced construction of the removed units prior to January 6, 1975, which makes them part of the SO_2 and PM-10 baseline concentration per 18 AAC 50.020(e)(1), and the NO_2 baseline concentration per 18 AAC 50.020(e)(2). Alyeska started operating the units in 1977, which is prior to the 1978 PM-10 baseline date, the 1979 SO_2 baseline date, and the 1988 NO_2 baseline date. Therefore, the actual emissions must be used instead of the allowable emissions for determining the baseline concentrations.

[13] Alyeska modeled the firewater pump at the potential emissions established under EPA guidance, *Calculating Potential to Emit (PTE) for Emergency Generators*, September 6, 1995. Since this is the unit's PTE, no permit restriction is required. According to Alyeska, past usage has been well below 500 hours per year.

Alyeska found that the existing firewater pump must have daily operating limits to protect the 24-hour PM-10 increment. They assumed the firewater pump only operates 10 hours per day in the modeling analysis and asked that we include this assumption as a permit condition.

The modeled emission rates and stack parameters are correct. However, the following issues warrant additional discussion.

Load Analysis

The maximum ambient concentration does not always occur during the full-load conditions that typically produce the largest emissions. The relatively poor dispersion that occurs with cooler exhaust temperatures and slower part-load exit velocities may produce the maximum ambient impacts. Therefore, EPA recommends that part-load conditions by analyzed as well as full-load conditions.

In addition to providing backup power needs, Alyeska plans to operate the Cat 3516B as a peak shaving unit to reduce the cost of purchasing electricity during peak conditions. Therefore, Alyeska initially evaluated the 36%, 44% and 100% load scenarios in their load analysis. Alyeska later used a two-tiered approach to address the load impacts from the Cat 3516B.

Alyeska first used a worst-case approach of modeling the 36% load stack characteristics and the maximum (full-load) emissions. This approach was adequate for the SO_2 and PM-10 demonstrations, but was too conservative for the NO_2 demonstration. Therefore, Alyeska used a refined approach in the NO_2 analysis by modeling the Cat 3516B twice: once under 36% load and a second time under 100% load. Alyeska then reported the higher of the two values. Alyeska also made the 36% load scenario conservative by assuming the Cat 3516B operates continuously (at 36% load) during the entire year. In the full-load NO_2 analysis, Alyeska assumed the Cat 3516B units operate at the requested combined limit of 11,200 hours per year.

Ambient SO_2 Modeling

SO_2 emissions are directly related to the amount of sulfur in the fuel. Alyeska plans to use diesel fuel to operate their existing and proposed combustion sources. Alyeska assumed the diesel-fired units are burning fuel with a maximum sulfur content of 0.24 percent, by weight. Alyeska asked that we include this limit in the construction permit.

Horizontal/Capped Stacks

The presence of horizontal stacks or stacks with rain caps requires special handling in an ISCST3 analysis. EPA recommends that the plumes be characterized with an artificially small exit velocity (0.001 m/s) and an "equivalent diameter" to conserve the volume flow rate.[14] The existing firewater pump has a horizontal stack. Therefore, Alyeska used EPA's recommended approach to characterize the stack parameters for this unit.

EPA also recommends turning the stack-tip downwash (STD) algorithm off for horizontal and capped stacks. ISCST3 contains a switch to turn off STD. However, the switch turns the STD algorithm off for *all* emission units in the input file. Consequently, this unilateral approach can be problematic for sources with a variety of stack discharge styles. As previously noted, RETEC modified ISCST3 to turn off STD for all units with horizontal stacks (i.e., all units with a 0.001 m/s exit velocity).

Ambient NO_2 Modeling

The modeling of ambient NO_2 concentrations can sometimes be refined through the use of ambient air data or assumptions. Alyeska used the national default ambient NO_2-to-NOx ratio of 0.75, as provided in EPA's *Guideline on Air Quality Models*, to refine the estimated ambient NO_2 concentrations. The 0.75 ratio is appropriate for this analysis.

[14] EPA Memorandum from Joseph Tikvart to Ken Eng, *Proposal for Calculating Plume Rise for Stacks with Horizontal Releases or Rain Caps for Cookson Pigment, Newark, New Jersey*, July 9, 1993.

Ambient Air Boundary and Receptor Grid

For purposes of air quality modeling, "ambient air" means outside air to which the public has access. Ambient air typically excludes that portion of the atmosphere within a stationary source's boundary.

Alyeska appropriately used the fence line as the ambient boundary. They used the following receptor grid density in the initial SO_2 and PM-10 significant impact level (SIL) assessment:

- 25-meter spacing along the fence line,
- 25-m resolution from the fence line outward to 100 meters,
- 100-m resolution from the 25-meter grid outward to 1 km in each cardinal direction from the fence line, and
- 250-m resolution from the 100-meter grid outward to 10 km in each cardinal direction from the fence line.[15]

Alyeska later expanded the 250-meter grid in the short-term SO_2 SIL analysis by 5 km to the west and south, and by 4.5 km to the east. In the NO_2 SIL analysis, Alyeska used extended the 250-meter grid used in the PM-10 analysis by 5 km to the west and south. The PM-10 SIL grid had 7,714 receptors, the SO_2 SIL grid had 13,268 receptors, and the NO_2 SIL grid had 11, 414 receptors. In all cases, the SIL receptor grid is sufficient for finding the significant impact receptors for the applicable pollutants.

In the full impact assessment, Alyeska limited the receptor grid to the 1,350 receptors that had significant impacts for any of the modeled pollutants. The resulting grid included all of the 25-meter resolution receptors, most the 100-meter resolution receptors and some of the 250-meter resolution receptors. The Department reviewed the full impact grid and confirmed that the resulting grid included all significant impact receptors.

Alyeska interpolated the receptor elevations from 1:63,360 Digital Elevation Model data obtained from the United States Geological Survey (USGS). They then overlaid the receptor elevation contours on a USGS topographical map to verify the resulting receptor grids. Alyeska provided the overlays in Figures 4-4 and 4-5 of their application. The modeled receptor elevations match the contours shown in the USGS quad map and are therefore, acceptable.

Downwash

Downwash refers to conditions where the plume pattern is influenced by nearby structures. Downwash can occur when a stack height is less than a height derived by a procedure called "Good Engineering Practice," as defined in 18 AAC 50.990(44). The modeling of downwash-related impacts requires the inclusion of dimensions from nearby buildings. EPA has established specific algorithms for determining which buildings must be included in the analysis and for determining the profile dimensions that would influence the plume from a given stack. EPA has incorporated these algorithms in a separate computer program called the "Building Profile Input Program" (BPIP).

Alyeska used BPIP (version 04112) to determine the building profiles needed by ISCST3.[16] This is the current version of BPIP.

Off-Site Impacts

In a cumulative impact analysis, the applicant must include impacts from large sources located within 50 km of the applicant's significant impact area. These impacts from "off-site" sources are typically assessed through modeling.

PS9 is located just south of Fort Greely. Therefore, Alyeska included the currently permitted Fort Greely emission units in the full impact assessment. There are no other off-site sources within 50 km of the PS9 significant impact area. Alyeska's approach regarding off-site sources is appropriate.

Background Concentrations

The background concentration represents impacts from sources not included in the modeling analysis. Typical examples include natural, area-wide, and long-range transport sources. The background concentration must be

[15] Page 4-11 of the application states the 250-meter grid extend 5 km from the source. This is a misprint. Alyeska actually extended the 250-meter grid 10 km from the source in the initial SO_2 and PM-10 modeling files.

[16] Alyeska's PS 9 application contains a typographical error regarding the BPIP version. Section 4.5 of the application states Alyeska used BPIP version 95086 (the previous version of BPIP). However, the electronic modeling files indicate Alyeska actually used BPIP version 04112.

evaluated on a case-by-case basis for each ambient analysis. Once the background concentration is determined, it is added to the modeled concentration to estimate the total ambient concentration.

Alyeska used the same background concentrations as used by GMD-JPO in the Fort Greely CE/IDO project. Alyeska obtained these data from the Department's modeling review memorandum for the CE/IDO project. GMD-JPO used ambient NO_2 and SO_2 data collected between 2000 and 2002 by Flint Hills Resources Alaska, LLC (Flint Hills) at their North Pole Refinery (NPR).[17] The refinery is located in the Alaska interior (as is PS9), and should provide a conservative estimate of the background NO_2 and SO_2 concentrations due to the impacts from the industrial sources located near the Flint Hills monitoring station.

For PM-10, GMD-JPO (and Alyeska) used ambient data collected in the early 1990s as part of the Healy Clean Coal Project near Denali National Park. These data have been used to characterize the background PM-10 concentration in a number of Alaska interior assessments. The Department is continuing to accept the Healy data for PS9.

The Department notes that the U.S. Army Space and Missile Defense Command (USASMDC) is currently collecting ambient PM-10 data at Fort Greely to obtain local background data for future assessments.[18] The USASMDC has not yet collected sufficient data for use in this application. However, Alyeska should use local data in future assessments, if available.

RESULTS AND DISCUSSION

The maximum NO_2, SO_2 and PM-10 AAAQS impacts are shown in Table 1. The background concentrations, total impacts, and ambient standards are also shown. All of the total impacts are less than the applicable AAAQS. Therefore, Alyeska has demonstrated compliance with the AAAQS.

Table 1 – Maximum AAAQS Impacts

Air Pollutant	Avg. Period	Maximum Modeled Conc ($\mu g/m^3$)	Bkgd Conc ($\mu g/m^3$)	TOTAL IMPACT: Max conc plus bkgd ($\mu g/m^3$)	Ambient Standard ($\mu g/m^3$)
NO_2	Annual	16.4	12.3	**29**	100
SO_2	3-hr	130	107	**237**	1,300
	24-hr	65	55	**120**	365
	Annual	4.2	7.8	**12**	80
PM-10	24-hr	16	31	**47**	150
	Annual	0.7	5.0	**6**	50

The maximum NO_2, SO_2 and PM-10 increment impacts are shown in Table 2, along with the Class II increment standards. All of the maximum impacts in Table 2 are less than the applicable Class II standards. Therefore, Alyeska has demonstrated compliance with the Class II increment standards.

[17] The North Pole Refinery was owned by Williams Alaska Petroleum, Inc. during the ambient monitoring period.

[18] The Department originally imposed post-construction PM-10 monitoring at Fort Greely in air quality control construction permit 238CP01. The Department has since incorporated this requirement in the operating permit for Fort Greely (238TVP01). The Department imposed post-construction monitoring to better characterize the dust storms, agricultural burns and wild-fires that periodically occur in the general Delta Junction area.

Table 2 - Maximum Increment Impacts

Air Pollutant	Avg. Period	Maximum Modeled Conc. ($\mu g/m^3$)	Class II Increment Standard ($\mu g/m^3$)
NO_2	Annual	**17**	25
SO_2	3-hr	**130**	512
	24-hr	**64**	91
	Annual	**4**	20
PM-10	24-hr	**16**	30
	Annual	**0.7**	17

It is important to note that since ambient concentrations vary with distance from each emission unit, the maximum values shown represent the highest value that may occur within the airshed. They do *not* represent the highest concentration that could occur at *each* location in the area.

CONCLUSION

The Department reviewed Alyeska's modeling analysis for PS9 and concluded the following:

1. The NO_2, SO_2 and PM-10 emissions associated with operating the stationary source within the requested operating limits will not cause or contribute to a violation of the AAAQS listed in 18 AAC 50.010 and the increments listed in 18 AAC 50.020.
2. Aleyska's modeling analysis fully complies with the showing requirements of 18 AAC 50.315(e)(2).
3. Alyeska conducted their modeling analysis in a manner consistent with EPA's *Guideline on Air Quality Models*.

The Department has developed conditions in the air quality control construction permit to ensure compliance with the ambient air quality standards and increments. These conditions are summarized below:

1. Limit the maximum sulfur content of diesel fuel to 0.24 percent, by weight;
2. Limit the combined annual operation of the Cat 3516B to 11,200 hours;
3. Limit the annual operation of the 65 kW RICE unit to 300 hours; and
4. Limit the operation of the existing firewater pump to no more than 10 hours per day (24-hour period).

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